CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL VALLEY REGION
Fact Sheet No. 5 For Dairies

Soil And Groundwater Assessments For Dairies

Introduction

The California Water Code requires that animal wastes be managed to protect water quality. To help achieve protection, regulations established pursuant to the Water Code (reference California Code of Regulations, Title 27, Subdivision 1, Chapter 7, Subchapter 2, Article 1, Section 22562d) require that holding ponds utilized for animal wastes be lined with, or underlain by, soils which contain at least 10 percent clay and not more than 10 percent gravel or be lined with artificial materials of equivalent impermeability. In addition, the Tulare Basin Water Quality Control Plan and some county ordinances require a 5-foot separation between the bottom of a holding pond and the highest anticipated groundwater elevation.

Title 27 also requires that manured areas (including corrals) be managed to minimize infiltration of water into underlying soils. Consequently, corrals and manure storage areas are usually designed and managed to reduce the potential for standing water ("ponding"). There are no state regulations that specify soil characteristics for corrals or manure storage areas. However, soils with low levels of clay and without underlying restrictive layers (such as a hardpan) are likely to allow significant infiltration. Studies conducted at dairies by the Central Valley Regional Water Quality Control Board have identified impacts to groundwater from corrals and manure storage areas.

The following information is provided to assist dairy owners who want to obtain soil and groundwater information related to environmental issues at existing or proposed dairy sites. Obtaining site-specific information is useful in developing recommendations for dairy design and operation. The following are not requirements, but can serve as a guide for discussions with consultants who conduct environmental assessments.

Assessments of Holding Pond Sites

Clay and gravel content in the sides and bottom of holding ponds is best evaluated by collecting samples from the pond excavation. However, an initial evaluation of soils can be made by using soil borings before the start of pond construction. The borings can also provide information on expected depth to groundwater. Cuttings or cores from the borings can be examined in the field by a geologist or soil scientist to assess soil type and soil variability at the site. If desired, soil samples from borings can be submitted for laboratory analysis to evaluate clay content and/or nitrogen levels. Borings can be also be used to evaluate several potential pond locations and the site with the "best soils" for a pond can be identified.

Assessments of Corrals

Soil borings in existing or proposed corrals can provide information on soil conditions including the presence of conditions that will restrict percolation. Analysis of soil samples from the borings can provide information on nitrogen levels under the corrals. Subsequent soil sampling and analysis can identify any changes in nitrogen levels to help assess the potential for corrals to impact groundwater.

Soil Borings

Soil borings can be completed with a drill rig or with direct-push technology. An alternative is to use a backhoe to construct trenches that can be used to examine site conditions and to collect soil samples. A qualified consultant can recommend the choice of technology based on expected site conditions and on cost and time considerations. The consultant can also recommend the placement and number of soil borings.

If a drill rig is used, continuous coring is recommended to allow an accurate assessment of soil conditions; an alternate but inferior method is to have a geologist log cuttings to evaluate the soil profile. When using a drill rig, soil samples can be collected at selected intervals by using a drive sampler. If direct-push technology is used, a cross section of the soil column is obtained inside plastic tubes that can then be sectioned to obtain soil samples to send for analysis.

Evaluation of Soil Samples

Soils from borings or excavations can be visually and tactually assessed in the field by a qualified geologist or soil scientist (reference ASTM Standard D2488 "Practice for Description and Identification of Soils - Visual-Manual Procedure"). Samples can be analyzed in a laboratory to evaluate clay and gravel content (reference ASTM Standard D422 "Particle Analysis of Soils"). Samples to be evaluated for nitrogen should be analyzed for nitrate (NO_3) and for total Keljdahl Nitrogen (TKN) by a state-certified laboratory using approved methods. There are also a number of soils tests that can be run to assess engineering properties of soils that may be useful in evaluating suitability of sites for buildings or other facilities.

Evaluation of Groundwater

Initial information on expected groundwater conditions can often be obtained from regional sources such as state or county agencies or irrigation districts. Local information may be available from wells constructed at nearby properties. Leaving a backhoe excavation open overnight may indicate if the groundwater elevation is higher that the base of the excavation. However, obtaining site-specific groundwater information generally requires the installation of monitoring wells. In some cases, temporary monitoring wells can be installed using direct-push technology, but such wells may not be allowed in some counties and will generally not be adequate for long-term monitoring. Permanent monitoring wells are usually installed with a drill rig and must meet county construction and administrative requirements. A minimum of three wells is generally required in order to assess groundwater gradients and evaluate upgradient ("background") water quality. Well head elevations need to be surveyed to a common reference point (usually mean sea level) and the depth to water needs to be periodically recorded (usually at the time of sampling) to establish groundwater gradients. Water samples should initially be analyzed for standard minerals, total dissolved solids (TDS), and nitrogen-containing compounds to obtain information that can be evaluated to assess impacts to water quality. An ongoing groundwater monitoring program may be focused at parameters of most concern (for example, TDS and NO_3) for periodic sampling and involve only an occasional wider range of tests.

Presentation of Results

A report should be prepared describing the field investigations and presenting the reported analytical results for samples submitted for analysis. Figures should be used to identify the locations of soil borings and sample collection. Photographs may be used to supplement the figures. Soil profiles should be presented graphically using boring logs. Groundwater gradient information should be presented in figures and tables and regional and local groundwater information should be summarized in a narrative format. Reported analytical results should be summarized in tables and graphs and the laboratory reports should be included as an appendix. A grain size distribution chart is useful for presenting results of clay and gravel content assessments of soil samples.